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surface of a wafer including a group III nitride compound semiconductor with ultraviolet rays to thereby clean a resist residue from the surface of the wafer. The ultraviolet rays cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer.

As noted in the Application, conventional wafer surface cleaning methods use O₂ plasma treatment. However, some layers of group III nitride compound semiconductor (e.g., p-type semiconductor) may have a high electrical resistance and, therefore, may be damaged by this method (Application at page 3, lines 2-12).

The claimed invention, on the other hand, irradiates a surface of a wafer including a group III nitride compound semiconductor with ultraviolet rays to thereby clean a resist residue from the surface of the wafer (Application at Figure 4; page 15, line 23-page 7). This helps to avoid damage to the group III nitride compound semiconductor, and improves a reliability of ball bonding to the wafer (Application at page 16, line 26-page 17, line 8; page 20, lines 5-12).

II. MANIAR

The Examiner alleges that Maniar teaches the invention of claims 21-23, 32 and 34-38, teaches and/or makes obvious the invention of claim 31, and makes obvious the invention of claims 33. Applicant would submit, however, that there are elements of the claimed invention which are neither taught nor suggested by Maniar.

Maniar discloses an aluminum nitride (AlN) anti-reflective coating 20 which is formed over a reflective, conductive layer 18. During photolithography, the AlN layer 20 absorbs UV radiation which allegedly prevents the radiation from reflecting off of the underlying conductive layer 18. (Maniar at Abstract).

Applicant would submit, however, that Maniar does not teach or suggest "*wherein said group III nitride compound semiconductor comprises a p-type group III nitride compound semiconductor*", as recited in claims 21 and 38.

As noted above, unlike conventional cleaning methods which use O₂ plasma treatment which damages some layers of group III nitride compound semiconductor (e.g., p-type semiconductor), the claimed invention irradiates a surface of a wafer including a group III nitride compound semiconductor with ultraviolet rays to thereby clean a resist residue from

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the surface of the wafer (Application at Figure 4; page 15, line 23-page 7). This helps to avoid damage to the group III nitride compound semiconductor, and improves a reliability of ball bonding to the wafer (Application at page 16, line 26-page 17, line 8; page 20, lines 5-12).

Clearly, this feature is not taught or suggested by Maniar. Indeed, the Examiner attempts to rely on col. 4, lines 26-45 to support his position. Specifically, the Examiner alleges that "[t]he resist material (position 34 on Fig. 4) (sic) located on the layer of aluminum nitride and is directly exposed to UV light, and therefore, the resist residue is inherently removed from (sic) Aluminum nitride layer" (Office Action at page 2).

However, Maniar teaches **only** using UV radiation in an imaging step to form the image on the resist layer 22 (Maniar at col. 5, lines 6-28). Applicant would point out that this irradiation is **only** used to cause portions of the resist layer 22 to undergo chemical changes such as photo-acid generation, which allows the resist layer 22 to be developed into a pattern using an alkaline solution (Maniar at col. 5, lines 6-15).

That is, Maniar does **not** teach or suggest using UV radiation to **clean resist residue** from the surface of the AlN layer, but instead **only to form the image** on the resist layer 22. In fact, Applicant would point out that at the point in time of the UV irradiation in Maniar, none of the resist layer 22 has been removed. Thus, **there is no "resist residue" on the surface of the AlN layer to be cleaned by using UV radiation.**

Indeed, Maniar teaches that after the UV irradiation in the imaging step, an alkaline solution is used to develop the image and pattern the resist mask 34 (Maniar at Figure 4). However, **nowhere does Maniar even teach or suggest that any resist residue may remain on the surface of the AlN layer 20 after the resist mask 34 is patterned.** Instead, Maniar goes directly from the patterning of the resist mask 34 to etching the pattern into the underlying layers (Maniar at col. 5, lines 21-24). Therefore, Maniar certainly does not teach or suggest irradiating a surface of the AlN layer 20 in order to clean such resist residue from the surface of the AlN layer 20.

In fact, Applicant would point out that Maniar is completely unrelated to the claimed invention in which a surface of a wafer including a group III nitride compound semiconductor with ultraviolet rays to **thereby clean a resist residue from the surface of the wafer**. That is, a function of the irradiating in the claimed invention may include **cleaning a resist**

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residue from the surface. This completely different from the function of the UV radiation in Maniar which is **only to form the image on the resist layer 22**. Thus, it is completely unreasonable for the Examiner to attempt to equate the irradiating step in Maniar with the irradiation of the wafer surface in the claimed invention.

Indeed, Applicant would point out that term "clean" may be defined as an effort "to rid of dirt, impurities, or extraneous matter" (*Webster's Universal Encyclopedic Dictionary*, Barnes and Noble Books (2002) at page 232). Further, the term "residue" may be defined as "something that remains after a part is taken, separated, or designated" (*Webster's Universal Encyclopedic Dictionary*, Barnes and Noble Books (2002) at page 1563). Nowhere does Maniar teach or suggest that the UV irradiation is used to "rid" the surface of the AIN of "a part" of the resist layer 22. Thus, it is very unreasonable for the Examiner to attempt to equate the UV irradiation for forming an image on the resist layer 22, with **cleaning a resist residue** as in the claimed invention.

Further, with respect to claim 32, Applicant respectfully submits that Maniar clearly does not teach or suggest "*wherein said irradiating said surface of said wafer is performed after patterning a resist layer on said group III nitride compound semiconductor*". Indeed, the Examiner **does not even** allege that this feature is disclosed in Maniar, but instead states only that "[w]ith respect to claim 32, Maniar discloses that after depositing AIN antireflective coating (ARC), a resist layer 22 is formed on ARC (see col. 4, lines 47, 48 and Fig. 2). The irradiation of resist layer deposited on AIN is performed (col. 4, lines 58-64)" (Office Action at page 3).

That is, the Examiner merely alleges that Maniar discloses irradiating a resist layer, and **no more**. Nowhere does the Examiner allege that Maniar teaches **that this** irradiating should occur after any particular step, and certainly not after a patterning step. Indeed, as noted above, Maniar teaches only using UV radiation in an imaging step to form the image on the resist layer 22 (Maniar at col. 5, lines 6-28), and does not teach or suggest irradiating a wafer surface **AFTER patterning a resist layer**. Thus, the Examiner has clearly failed to even allege that Maniar teaches or suggests the features of claim 32.

Therefore, Applicant would submit that there are elements of the claimed invention that are not taught or suggest by Maniar. Therefore, the Examiner is respectfully requested to withdraw this rejection.

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III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 21-24 and 31-32, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

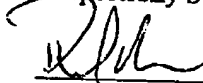
Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Date:

11/22/05

Respectfully Submitted,



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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that the foregoing Amendment was filed by facsimile with the United States Patent and Trademark Office, Examiner Michail Kornakov, Group Art Unit # 1746 at fax number (571) 273-8300 this 22nd day of November, 2005.



Phillip E. Miller

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